

## TITLE OF INVENTION

Sealed Tight

This application claims benefit of provisional  
application #60/270,590 filed 2/23/2001.

CROSS-REFERENCE TO RELATED APPLICATIONS Not-Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not-Applicable

REFERENCE TO SEQUENCE LISTING, A TABLE, OR A COMPUTER PROGRAM

LISTING COMPACT DISC APPENDIX Not-Applicable

## BACKGROUND OF THE INVENTION

0001 Sealed Tight is an agricultural waste treatment system that uses psychrophilic anaerobic digestion to dispose of animal waste solids and aquatic plants to purify filtered effluent.

0002 Psychrophilic anaerobic digestion has shown promise as a way to dispose of animal wastes. This is as described by Cullimore in the Agricultural Waste journal from December, 1985. The problem with existing systems is the inability to handle the volume of the waste stream of ever-expanding facilities. These are hopper-type digesters.

0003 Existing methane capturing systems are floating systems, fitted with pockets to capture biogas, and cover

and are at danger in flood situations.

0004 Aquatic plant filtering of degraded water has been proven to be as effective as conventional sewage treatment systems, as shown in the work of Wolverton in the 1980's. The problem with this type of system is that it is limited by climate, and is primarily used for aquaculture of fish. Existing systems are designed to use plants as the primary filter of degraded water.

#### BRIEF SUMMARY OF THE INVENTION

0001 Sealed Tight is a sealed system that converts existing waste storage systems into anaerobic digesters. Sealed Tight decreases the dangers of environmental contamination from agricultural waste and reduces the amounts of contaminants released. The capacity created by converting existing pit into a digester, and longer holding time, causes manure to be more thoroughly digested than in existing systems. Finished slurry is of a greater grade, increasing the availability of nutrients to plants, thus adding value. Sealed Tight provides a complete waste treatment system and an economical solution to the dangers of agricultural waste contamination.

0002 Sealed Tight uses vacuum for ballast, eliminating the danger of wind damage to the membrane. Vacuum pressure also eliminates the danger of the membrane lifting off the pit in a flood situation.

0003 Sealed Tight is a complete waste treatment system. Aquatic plants are used to treat filtered effluent from the

to decrease ground water contamination and dangers of flooding.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Figure 1A Cross-Section View of the Sealed Tight system

- 1 End view of overflow canal
- 2 Greenhouse over canal
- 3 Micro-filter to filter effluent
- 4 Valves to control the flow of effluent
- 5 Pipe to pump gas to storage
- 6 Concrete retaining wall around pit
- 7 Emergency Photovoltaic Pump
- 8 Pressure switch to control pressure in digester
- 9 Diaphragm Membrane
- 10 Drain for finished sludge
- 11 Inlet for waste
- 12 Augers
- 13 Valve to seal system in flood stage

Figure 2A Cross-section of Overflow Canal

Figure 2B End View of Overflow Canal

- 14 Doors to Greenhouse
- 15 Spillway for Canal
- 16 Overhead Harvester
- 17 Effluent Inlet

## DETAILED DESCRIPTION OF THE INVENTION

0001 Sealed Tight is a continuous flow, psychrophilic anaerobic digester, micro-filtration, integrated aquaculture waste treatment system that eliminates the danger of flood damage. Sealed Tight converts existing manure pits into anaerobic digesters and uses aquatic plants in an overflow canal to convert nutrient-rich effluent into feed for livestock.

0002 The anaerobic digester consists of an airtight diaphragm secured to a concrete beam. The diaphragm is kept under negative pressure for ballast, for protection during flood situations. Pressure is regulated by a pressure switch located on the vent to keep the digester under vacuum. The perimeter beam is plumbed to receive waste stream, to pump off biogas, to provide for effluent overflow, and to remove fully processed slurry. The pipe for incoming waste is fitted with an auger sufficient to mix and distribute waste throughout the pit. Augers will also be placed at other points in the digester. The number and placement of the augers will be dependent on the size and shape of the pit. Biogas is pumped into a storage tank and an emergency photovoltaic pump is located on the vent, above flood stage, to flair off gas during a flood. Valves are located on an overflow pipe to control the flow of effluent, to allow for the settling of slurry in the digester before effluent is

0003 Effluent then flows through a micro-filter, separating out solids. Once through the micro-filter, effluent flows into one end of the adjacent canal, which is lined to prevent ground water contamination. The nutrient-rich water is filtered by the growth of aquatic plants. The purified water flows out the other end of the canal.

0004 The overflow canal is four feet deep, the average length of the feather-like roots of the water hyacinth. The overflow canal has a surface area of at least one eighth that of the digester. Water hyacinth has been shown to effectively treat water prior to release in the environment. The canal is covered by a hoop-type greenhouse to divert rainwater into adjacent ditches, and to protect the tropical plants during the cold season. The greenhouse is also enclosed to prevent the spread of water hyacinth into the ecosystem. An overhead conveyor belt is suspended from the ceiling; it is used to push plants out the end of the canal to be harvested.

0005 Sealed Tight will not interfere with normal operations of the farm. The farmer will continue to dispose of manure using existing procedures and equipment. The farmer must only close the overflow valve before sending manure into the pit and run augers for at least thirty minutes each cleaning. The farmer must allow at least eight hours for

harvest plants periodically, depending on growth. To harvest, the farmer will open the doors to the greenhouse and extend the conveyor out the end of the greenhouse. The farmer will then turn on the conveyor, which will push plants over the spillway. The plants will then be used for feed.